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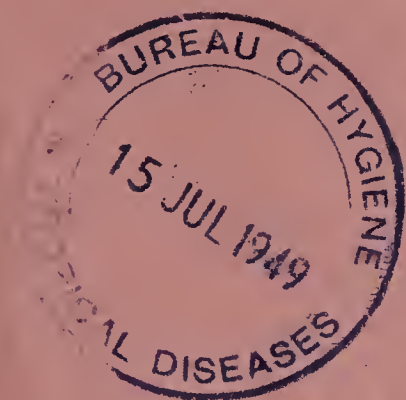
ANNUAL REPORT

OF THE

SUDAN VETERINARY SERVICE

FOR THE YEAR

1946



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ANNUAL REPORT

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SUDAN VETERINARY SERVICE

FOR THE YEAR

1946

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GENERAL.

A Livestock and Veterinary Policy Committee composed of :
Director, Department of Economics and Trade, (Chairman),
Director of Agriculture and Forests,
Director, Sudan Veterinary Service,

A representative of the Civil Secretary,
was set up by the Board of Economics and Trade at its 35th Meeting on 26th February and was given the following terms of reference :—

“ To study the livestock problems of the country as a whole and to make suggestions to the Board of Economics and Trade on the lines of the Board's recommendations at its 35th meeting for the country's future livestock and veterinary policy in all its aspects (including animal husbandry and dairying), for the apportionment of departmental responsibility in the implementation of that policy, and for the nomination of a co-ordinating authority for the departmental responsibilities.”

The Board's recommendations referred to above were :

“ That in view of the importance of animals to the life of the Sudanese, to the fertility of the soil, and, within the limitations of native conservatism, to the economic development of the country, there is urgent need for increasing the staff of the Veterinary Department. That for the achievement of progress in animal husbandry there must be the closest co-operation between the Veterinary and the Agriculture Departments.”

The Committee submitted its report in July to the Board of Economics and Trade who recommended :—

1. That the control of animal numbers by disease should not be accepted as good policy. That a campaign of widespread immunisation should be begun immediately in Darfur and intensified work elsewhere, particularly in Equatoria and the Northern Province. That in a limited and selected area of Darfur, with the agreement of the local authorities, an experiment in compulsory immunisation should be conducted.

2. That real veterinary research work should proceed at the same time as an expansion of field work and that the veterinary research staff should be so reinforced as to make this possible in addition to the work they do in the preparation of prophylactics.

3. That the main lines of the Sudan Government's Veterinary Policy should be defined, in the order of their priority, as :

- I. (a) Collection and co-ordination of information, including work on trypanosomiasis.

(b) Large scale immunisation against disease in one province (Darfur) coupled with improvement of water supplies and environment and a limited increase in the control of disease generally, and particularly in Equatoria and the Northern Province ;

(c) An increase in Veterinary Research, apart from the production of prophylactics.

II. (a) Consideration of progress made under Stage I and (if justified by results they have attained) ;

(b) the application of a similar policy to the remainder of the Sudan by stages.

III. Improvement of stock (appointment of a geneticist) with regard primarily to milk yield and secondarily to meat production in cattle. The future of the export trade was still not sufficiently clear to warrant putting meat supplies before milk. In the future, increased export of meat on the hoof, frozen, dehydrated, or canned might change the relationship if the numbers of cattle increase. Also to be considered (and of importance in the Northern half of the Sudan) was the use of cattle for work. Some experience in India had indicated that milking capacity often goes hand in hand with general usefulness.

4. That, arising out of recommendation 3 I (b) above, the attention of the Rural Water Supplies and Soil Conservation Board should be drawn to the urgent need for the expansion of water supplies in grazing areas, particularly in Darfur, to provide for utilisation of grazing areas not at present available owing to lack of water and thus to allow for the larger number of animals which might be expected to result from a policy of widespread immunisation from disease.

5. That the matter of provision of additional staff for the implementation of Stage I, listed in Appendix I to the Committee's report, which the Board noted, should be taken up by the Director of the Veterinary Service with the Director of Establishments. This also applies to the "hide grader" whose early recruitment is emphasised by the situation set forth in Minute 183.

6. That the attention of the appropriate authority should be drawn, to the urgent need for increasing the number of pupils in the Veterinary School for training as Veterinary Officers and that energetic steps should be taken to strengthen and train the cadre of Veterinary Assistants.

7. That a permanent organisation should be set up at an early date for the compulsory grading and marking of hides for export and that an amendment of existing legislation should be proposed to give it effect. The Board recommend that the Director of Customs should be fully consulted in the preparation of the scheme as it was his Department which would have to control its application.

8. That energetic steps should be taken to expedite the building of new headquarters premises for the Veterinary Department, the present accommodation being inadequate for existing staff, much more so for the expanded staff now to be proposed.

9. That the Committee which had been appointed for the purpose of making the present report should remain in being as a standard committee of the Board, with the same constitution, to co-ordinate and inspire future policy concerning livestock and Veterinary matters and the work of the Agricultural and Veterinary Departments in that sphere, to take advantage of the several media of research and scientific work in the country, to be responsible for the framing of policy and for the encouragement of dairying, and to make recommendations to the Board for long-term policy on all aspects of animal policy in the Sudan.

SECTION I.

STAFF.

Three vacant Veterinary Inspector posts were filled during the year and two Veterinary Research Officers and a Hides Specialist were selected, but had not taken up their appointments by 31st December. Owing to recruitment difficulties it was impossible to fill two additional posts of Veterinary Inspector as well as those of Entomologist and Pasture Research Officer.

DISTRIBUTION OF CLASSIFIED TECHNICAL STAFF AS AT 31st. DECEMBER, 1946.

DESIGNATION.	NAME.	STATION.
Director	W. H. Glanville, 4N., M.R.C.V.S.	Khartoum
Senior Veterinary Inspector	Capt. T. Menzies, O.B.E., 4N., M.R.C.V.S., D.V.S.M. (vict.)	El Obeid.
" " " "	J. E. Furney, 4N., M.R.C.V.S.	Wad Medani
" " " "	I. A. Gillespie, M.R.C.V.S.	Kassala
" " " "	(Vacant)	Khartoum
Veterinary Inspector and Dean Khartoum Veterinary School	A. W. Chalmers, M.R.C.V.S.	Khartoum
Veterinary Inspector	P. Durran, M.R.C.V.S.	El Fasher.
" " " "	J. D. M. Jack, M.R.C.V.S.	Khartoum.
" " " "	J. K. Thomson, M.R.C.V.S., D.V.S.M.	Malakal.
" " " "	P. Z. Mackenzie, M.B.E., M.R.C.V.S.	Wau.
" " " "	H. B. Luxmoore, B.Sc., M.R.C.V.S.	Khartoum.
" " " "	D. G. Clow, M.R.C.V.S.	El Obeid.
" " " "	T. Stewart, M.R.C.V.S.	Wad Medani
" " " "	Vacant	Nyala
" " " "	Vacant	Yirrol
" " " "	Vacant	Kosti
Inspector of Hides	Vacant	Khartoum
Superintendent	J. McKay	Khartoum
A/Superintendent	G. M. Anderson	Khartoum
Veterinary Officer	Ibrahim Mohd. Khalil, Dip. Vet. Sci.	Khartoum
" " " "	Ahmed Mugzoub Abdoun, Dip. Vet. Sci.	El Obeid
" " " "	El Nazzer Daffala Elias, Dip. Vet. Sci.	Khartoum
" " " "	Saad Mehanna Ahmed, Dip. Vet. Sci.	Khartoum
" " " "	Hussein Hassan Abbo, Dip. Vet. Sci.	Kassala
" " " "	Zein El Abdin Mahmoud, Dip. Vet. Sci.	Wadi Halfa
Veterinary Overseer	Abdulla Hassan Shafie	Khartoum
" " " "	Ahmed Mahmoud Hamza	Wadi Halfa
Animal Husbandry Officer	Fuad Hassan Lutfi	Khartoum
" " " "	Mohammed Abdulla Hassan	Khartoum

DESIGNATION.	NAME	STATION
	RESEARCH.	
Senior Veterinary Research Officer	J. T. R. Evans, B.Sc., M.R.C.V.S.	Khartoum
Veterinary Research Officer	Vacant	Khartoum
„ „ „ ..	Vacant	Nyala
Entomologist	Vacant	Khartoum
Pasture Research Officer ...	Vacant	Khartoum
Veterinary Officer	El Amin Abdulla, Dip. Vet. Sci.	Malakal
„ „ „ ..	Mohammed Ali Mihemied, Dip. Vet. Sci. ...	Khartoum
Laboratory Assistant ...	El Rashid Abdel Nebi	Khartoum
„ „ „ ..	Hassan El Fiki Ibrahim	Malakal

**ESTABLISHMENT OF OTHER CLASSIFIED STAFF AS
AT 31st DECEMBER, 1946.**

- 1 Head Clerk.
- 10 Clerks.
- 4 Bookkeepers.
- 2 Storekeepers.
- 25 Head Stockmen.
- 1 Southern Supervisor.
- 5 Southern Stockmen.

UNCLASSIFIED STAFF AS AT 31st DECEMBER, 1946.

- 70 Stockmen.
- 1 Carpenter.
- 3 Storemen.
- 7 Motor Drivers.
- 9 Messengers.
- 69 Veterinary Attendants.
- 20 Temporary Veterinary Attendants.
- 3 Shoeing Smiths.
- 2 Pump Mechanics.
- 1 Watchman.

SECTION II.

DISEASES OF ANIMALS.

It would appear that a number of diseases, which in a normal year cause negligible losses, were responsible this year, owing to the heavy rains and high Nile, for exceptionally heavy mortality among camels, cattle and sheep. Fascioliasis was reported to have caused many deaths in cattle and sheep in the Blue Nile and Upper Nile Provinces. It is thought that haemorrhagic septicaemia was mainly responsible for the serious losses that occurred among camels in Darfur and Kordofan while reports indicated that footrot in sheep was very prevalent in Kordofan.

Cattle Plague.

Reports from Veterinary Inspectors indicated that the incidence of cattle plague was lower than in 1945 in all Provinces except Kordofan, where outbreaks occurred in every district. In Western Kordofan there were widespread outbreaks, which were difficult to control in Dar Hamr, owing to instructions and general procedure for control of the disease having been ignored by cattle owners and the Tribal administration.

In Blue Nile Province losses were comparatively low but the province allotments of serum and vaccine were insufficient to meet all demands.

In Darfur Province outbreaks were more numerous than usual in the early part of the year and a large proportion of the Province's allotment of serum was expended in their control. Fortunately no large scale outbreaks occurred after the rains. It was impossible, as in all other provinces, to meet the demand for vaccine and the Province Veterinary Inspector had the usual difficulty in deciding how the Province's allotment could be used most profitably.

No serious outbreaks occurred in Kassala, Khartoum or Northern Provinces. The disease position in Equatoria Province was not clear, as it was not until December that it was possible to post a Veterinary Inspector to the Province.

In the Upper Nile Province the disease was reported from all districts and although demands for vaccine greatly in excess of the Province's allotment were made cattle owners are gradually beginning to realise the benefits of serum after several years distrust of this prophylactic.

Approximately 282,000 doses (30 cc) of serum and 318,000 doses (10 cc) of vaccine were issued for the control of cattle plague throughout the country.

Contagious Bovine Pleuro-Pneumonia.

Outbreaks in Darfur and Kordofan were not as numerous as in previous years. There was a slight increase in the number of outbreaks in Blue Nile Province. There appeared to be little change in the incidence of the disease in the South—widespread outbreaks being reported from the Upper Nile and Equatoria Provinces. Kassala Province remained free of the disease except for four isolated cases, two at Port Sudan and the same number at Kassala. It is believed that the disease was brought in by “lungers” from outside the Province. No cases were reported from Northern or Khartoum Province.

Trade cattle were remarkably free of the disease. The number of cases detected in the export quarantines was .021 per cent. of the cattle exported compared with .4 per cent in 1945 and 1.3 per cent. in 1925.

57,045 doses of vaccine were issued for the control of the disease compared with 36,434 in 1945.

Foot-and-Mouth Disease.

The disease was reported from Darfur, Kordofan and Blue Nile Provinces but as a result of the routine inoculation of all export cattle no interruption of their movement occurred.

Trypanosomiasis (Cattle).

There was a large increase in the incidence of trypanosomiasis in cattle (*T. congolense* and *T. vivax*) in non-tsetse fly areas.

In the Upper Nile Province the disease was widespread. The Province Veterinary Inspector reported that at least 20 per cent. of the cattle population were infected and that the disease was the most serious problem yet encountered in the Upper Nile Province. There was no evidence that extension of the tsetse fly belts along the western and southern borders of the province had occurred. It was thought that an increase in the number of non-tsetse biting flies, increased movement of trade cattle, and a gradual increase in the incidence of infection until mechanical transmission played a major part were all factors responsible for the increased incidence of the disease.

In the Blue Nile Province it was reported that *T. congolense* caused considerable losses in Kosti district during the period September to November.

After a lapse of some years trypanosomiasis reappeared at Kadugli in the Western Jebels district of Kordofan Province and caused five deaths amongst Government cattle. The disease was also diagnosed in the cows of a dairy in El Obeid. One animal died and four were treated successfully with stibophen.

The only drugs available for treatment of cattle trypanosomiasis necessitated a course of five weekly injections which was impracticable for large scale application among tribal herds. The research section carried out investigations into the chemotherapy of *T. congolense* infection in cattle and the results justified trials of new drugs in field experiments (see report of Senior Research Officer which follows).

Camel Trypanosomiasis.

Following the exceptionally heavy rains the disease in camels (*T. evansi*) was prevalent in Darfur, Kordofan, Blue Nile and Kassala Provinces. Demands for treatment with antrypol were again high and a total of 66,923 doses (5 gm.) were issued, the vast majority on payment to privately owned camels but some 2,500 doses were issued for the treatment of Government camels. As further cases of an antrypol-resistant strain of *T. evansi* were reported it was decided to increase the routine dosage from 5 grammes to 10 grammes.

Anthrax.

The number of cases of anthrax among cattle and sheep in the Export Quarantines was 33 compared with 129 in 1945. These cases occurred before it was decided to vaccinate all export cattle against the disease; 29,700 doses were issued for this purpose. No cases of anthrax were reported from the provinces.

African Horse Sickness.

In spite of the heavy rains remarkably few cases of the disease were reported (3 Khartoum, 1 Blue Nile and 1 Darfur). 1,556 doses of vaccine were issued compared with 1,442 in 1945.

Cryptococcus Infections.

The number of animals destroyed was 68 compared with 45 last year. The heaviest losses occurred amongst police mules in the Fung district of the Blue Nile Province and amongst police horses in the Nuba Mountains (Kordofan Province).

Rabies.

The following table shows the number and distribution of positive cases of rabies :—

PROVINCE	Dogs	Cattle	Donkeys	Horses	Goats	Total
Kordofan	10	—	1	—	—	11
Blue Nile	16	1	2	1	—	20
Khartoum	12	3	3	—	1	19
Kassala	2	—	—	—	—	2
Darfur	1	—	—	—	—	1
Equatoria	4	—	—	—	—	4
Northern	1	—	—	—	—	1
Upper Nile	2	—	—	—	—	2
TOTALS	48	4	6	1	1	60

SECTION III.

TRADE IN LIVESTOCK AND LIVESTOCK PRODUCTS.

EXTERNAL TRADE.

Cattle and Sheep.

From January to August export of cattle and sheep was limited to the British Military Authorities in the Middle East. During this period 22,231 cattle and 56,089 sheep were delivered at Shellal compared with 23,933 cattle and 76,126 sheep during the same period in 1945. Average weights and prices of cattle at Shellal were 350.98 Kilos and £E. 11.933 m/ms, while sheep averaged 46.72 Kilos and £E. 2.897 m/ms.

The total value of cattle and sheep handed over to the Military Authorities at Shellal during the period 1942 to 1946 was £E. 2,989.260 m/ms. The following table gives details of these animals :—

CATTLE.

Year	No. of Head Exported	Total Kiloage	Total Value £E. m/ms.	AVERAGE.		
				Weight per head Kilos	Value per head £E. m/ms.	Rate per Kilo Live weight m/ms.
1942	50,834	19,484,194	471,029.796	383.29	9.266	24.17
1943	40,585	14,467,402	360,098.278	356.47	8.870	24.88
1944	33,702	11,625,169	316,897.576	344.94	9.403	27.26
1945	35,520	12,333,425	381,293.886	347.20	10.735	30.91
1946	22,231	7,802,831	265,296.254	350.98	11.933	34.00
	182,872	65,713,021	1,794,615.790	359.33	9.813	27.31

SHEEP.

Year	No. of Head Exported	Total Kiloage	Total Value £E. m/ms.	AVERAGE.		
				Weight per head Kilos	Value per head £E. m/ms.	Rate per Kilo Live weight m/ms.
1942	155,045	7,230,664	320,304.794	46.63	2.066	44.30
1943	90,977	4,058,331	192,271.984	44.60	2.113	47.37
1944	101,953	4,543,498	231,334.827	44.56	2.269	50.91
1945	114,514	5,148,192	288,245.215	44.09	2.517	56.00
1946	56,089	2,620,773	162,487.926	46.72	2.897	62.00
	518,578	23,601,458	1,194,644.746	45.51	2.303	50.61

To prevent inflation of internal prices when free export of cattle and sheep was allowed in September, freight and veterinary charges were increased. This measure was fully justified as the average price in Cairo of the first consignment of cattle was approximately £E. 30. Cattle prices in Egypt gradually declined until at the end of the year the average price was about £E. 20.

During August and early September the movement of export cattle and sheep had to be suspended on account of the interruption of rail traffic to Wadi Halfa due to the high floods.

The total number of cattle exported during the year was 30,314 valued at £E. 352,217 compared with 36,281 valued at £E. 354,059 in 1945.

Sheep exports totalled 62,774 valued at £E. 162,077 compared with 116,954 valued at £E. 263,786 in 1945.

Camels.

It is estimated that about 46,500 camels were sold in Egypt at an average price of approximately £E. 23 per head. Senior Veterinary Inspector Kassala Province reported "the camel trade continued active and prices showed no signs of falling. Permits for the export of 24,706 camels were issued in Kassala Province compared with 26,471 issued in 1945."

Hides and Skins.

There was a marked drop in hide exports, 800 tons valued at £E. 70,921 were exported compared with 2,124 tons valued at £E. 171,813 in 1945. The fall in exports was mainly attributable to the increased internal demand for hides by tanners. The Hides Pool in Omdurman received 1060.5 tons of hides compared with 1021.25 tons but 90 tons were delivered to the mechanical tannery in Omdurman and 196 tons to other local tanners (corresponding figures for 1945 were 49 and 78 tons). The prices of first class airdried framed hides were further increased to promote their production.

Exports of sheep and goat skins increased from 948 tons value £E. 206,210 in 1945 to 974 tons valued at £E. 176,848.

INTERNAL TRADE.

The number of animals slaughtered for food in the ten principal towns of the Sudan as compared with the four previous years is shown below :—

Year	Camels	Cattle	Sheep	Goats
1942	2,203	43,653	182,408	18,225
1943	1,753	40,989	159,971	19,376
1944	1,884	40,644	201,932	18,569
1945	2,470	37,377	200,713	22,881
1946	1,871	34,274	192,225	24,800

SECTION IV.

IMPROVEMENT OF LIVESTOCK.

Bloodless castration of bulls considered unsuitable for breeding was carried out in numerous districts.

In Khartoum Province about 500 bulls were castrated by tribesmen trained to use the bloodless castrator. The bulls after castration were fattened on the riverain cultivations and subsequently sold in the Omdurman market. It is reported that these animals realized prices ranging from £E. 30 to £E. 40.

At the horse shows in Darfur 148 remounts were purchased. Although this number was slightly short of requirements it exceeded expectations. The two southern shows at Abu Salaa and Sibdu were not, for various reasons, well attended and it was therefore difficult to assess properly the horse-breeding position among some of the tribes. 26 horses were selected as tribal stallions and since 1945 when it was decided to retain each year the best remounts as stallions, 51 new tribal stallions have been purchased which otherwise would have been nearly all lost to the tribes. The total number of mares served during the year by the Government stallions at the Nyala stud was 360.

Thirty-six remounts were purchased at a Homr Tribal Gathering at Muglad, Southern Kordofan. Senior Veterinary Inspector Kordofan Province reported that the number of Homr horses has decreased greatly since prewar times and that although the size and quality have not improved the good pony is quite a fit and suitable animal for police and pack work. In Kordofan Province Government stallions standing at El Obeid, Nahud, Abu Zabad and in the Homr country covered approximately 130 mares.

The Arab stallion stationed in Khartoum covered 40 mares.

SECTION V.

EDUCATION.

There were three students in the Khartoum Veterinary School attending the course for the first professional examination which is normally held in December. Owing to illness and absence on duty of some of the part-time lecturing staff and to the closure of the Gordon Memorial College in November it was not possible to complete the course by the end of the year.

The students spent six weeks in Southern Kordofan during the early rains. Their reports made interesting reading principally because they illustrated very vividly the wide gap between the town-bred Sudanese and the pastoralist—a much wider gap than that between a university student and a farm labourer in Britain.

SECTION VI.

MISCELLANEOUS.

Exceptionally heavy and late rains provided excellent grazing during the latter half of the year in most provinces but the flooding of the River Nile deprived animals in some areas of normal river grazings for several months. It was reported that heavy cattle losses through starvation occurred in Southern Darfur before the rains broke as a result of abnormally poor grazings on the Bahr El Arab river.

Veterinary Hospitals.

Khartoum Veterinary Hospital and Forge :

In-Patients	214
Out-Patient attendances	5,167
Pairs of Shoes fitted :	
(a) Handmade	1,538
(b) Machine made	169
Hoof trimming, etc.	613

Wad Medani Veterinary Hospital :

In-Patients	220
Out-Patient attendances	2,163

The year was an extremely busy and difficult one for all staff. Most provinces were short staffed owing to illnesses and recruitment difficulties, motor and river transport was often inadequate, drugs and instruments were in short supply and the shortage of housing, office and laboratory accommodation was more serious than in previous years.

(Sgd.) W. H. GLANVILLE.

Director,

Sudan Veterinary Service.

APPENDIX I.

The following figures show the actual revenue and expenditure of the Sudan Veterinary Service for the past 3 years :—

	1944	1945	1946
1. Revenue £E	38,658	35,822	52,574
2. Expenditure			
(i) Personnel and Personal Allowances £E	26,224	25,811	29,049
(ii) Services £E	18,357	22,773	33,247
(iii) Capital £E	—	350	2,327
TOTAL £E	44,581	48,934	56,893

ANNUAL REPORT OF THE SENIOR RESEARCH OFFICER

A. STAFF.

The laboratory staff was one Veterinary Research Officer under establishment at the beginning of the year. Approval was given for the recruitment of one additional Veterinary Research Officer, one Entomologist, one Pasture Research Officer and two Sudanese Veterinary Officers, and the establishment of the technical classified staff at the end of the year was as follows :—

- 1 Senior Research Officer.
- 2 Veterinary Research Officers
- 4 Sudanese Veterinary Officers
- 1 Entomologist
- 1 Pasture Research Officer.
- 2 Sudanese Laboratory Assistants.

Nazeer Eff. Dafalla and Saad Eff. Mehanni, Diplomates in Veterinary Science of the Gordon Memorial College, Khartoum, were appointed laboratory Veterinary Officers. Mr. F. W. Priestley, M.R.C.V.S., Dip. Bact. (Lond.) and Mr. A. Mackay, B.Sc., M.R.C.V.S., were selected as Veterinary Research Officers but had not taken up their appointments at the end of the year. The posts of Entomologist and Pasture Research Officer could not be filled.

B. ROUTINE WORK.

The main items of routine work were, as usual, the following :—

- I. Preparation and issue of cattle plague antiserum (Malakal).
- II. Preparation and issue of cattle plague vaccine (Khartoum and Malakal).
- III. Issue of cattle plague virus for “serum-simultaneous” immunisation (Khartoum).
- IV. Preparation and issue of contagious bovine pleuro-pneumonia vaccine (Khartoum).
- V. Issue of diagnostic materials (for the mercuric chloride test) and of antrypol for the control of camel trypanosomiasis (Khartoum).
- VI. Distribution of horse-sickness vaccine purchased from Kenya (Khartoum).
- VII. Preparation and issue of blackleg vaccine (Khartoum).
- VIII. Issue of foot and mouth disease virus (Khartoum).
- IX. Distribution of anthrax vaccine purchased from Kenya (Khartoum).
- X. Examination of specimens (Khartoum and Malakal).

I. Cattle Plague Antiserum.

A total of 5,102.4 litres (170,080 nominal doses of 30 cc) was prepared. The estimated maximum output of the Malakal laboratory is 6,000 litres, and, as in the preceding two years, the chief reason why this amount could not be produced was the high incidence of *T. congolense* infection amongst the serum producers.

The field requirements of serum were greater than usual and it was not possible towards the end of the year to satisfy all the demands.

The supply of large cattle (serum producers) was adequate, even to meet the additional demands resulting from abnormal losses from trypanosomiasis during the usual period of "farming out" of the cattle over the rainy season. Eight hundred and ten bulls were purchased for cash and 51 obtained by barter for cattle plague vaccine (one bull for sixty doses).

Small cattle (virus producers) were also in adequate supply. Thirteen hundred and ninety three were obtained by barter for vaccine (one small bull for twenty doses) and 165 were purchased for cash. About 13 per cent of them proved to be immune against cattle plague. As many as were required were used for providing virulent blood for the hyperimmunisation of serum producers and their lymphoid tissues converted into vaccine; the remainder were used solely for producing vaccine.

II. Cattle Plague Vaccine (Glycerinised Lymphoid Tissue)

Practically all the raw material for this vaccine came, as usual, from the Malakal laboratory, and much of it, as indicated above, was a by-product of serum production. Altogether 348,880 standard doses of 10 cc were prepared and distributed to the provinces.

Although this amount exceeded the previous year's issues by about 27,000 doses and was the highest total for any year, it sufficed to satisfy only a fraction of the demands.

III. Cattle Plague Virus.

The issue of 5,405 doses of cattle plague virus, in the form of glycerinised lymphoid tissue, was about fifteen hundred doses in excess of that for any previous year. The virus was mainly used for the serum-simultaneous immunisation of working oxen in the Blue Nile Province. A few grade cattle in Khartoum were immunised by injecting virus a fortnight after vaccination.

IV. Contagious Bovine Pleuro-Pneumonia Vaccine.

The issue of this culture vaccine rose from 36,434 doses in 1945 to 57,045 doses. Its distribution had to be discontinued for two months on account of an unexplained sudden flaring-up of virulence resulting in the death of many cattle. Efforts have been made to avoid recurrences of these sudden, rare and inexplicable "accidents."

V. Camel Trypanosomiasis Control.

The development of an antrypol-resistant strain of *T. evansi* was reported in the preceding year. As there was no other known satisfactory drug for the treatment of *T. evansi* in camels it was decided to increase the routine dosage of antrypol from 5 grams to 10 grams in the hope that more cases would be cured.

There were reports of the existence of incurable infections from most of the camel rearing areas but the number of animals involved was far less than had originally been feared.

Trypanosomes were sent to Dr. Davey of the Imperial Chemical Industries (the manufacturers of antrypol) and he confirmed the existence of marked antrypol-resistance in them. Much experimental work on the chemo-therapy of these trypanosomes has been done by him and it is hoped that soon a new drug will become available for trial in the Sudan.

Experimental treatment with diamidines and phenanthridinium compounds was tried in the Sudan and the results are reported in the section dealing with Research.

A total of 66,923 doses (5 gm) of antrypol were distributed, the vast majority of them being issued on payment for the treatment of privately owned camels.

VI. Horse Sickness Vaccine.

As in previous years this neuro-vaccine was purchased from the Kenya Veterinary Service and distributed from this laboratory.

The demands for the vaccine rose slightly from 1,442 doses in 1945 to 1556 doses in 1946. The results following its use were again excellent.

VII. Blackleg Vaccine

There was only one request for blackleg "anaculture" vaccine. Although there are several known infected areas, the losses have been so irregular that the cattle owners have hitherto refused to have their young stock vaccinated annually.

VIII. Foot and Mouth Disease Virus.

All cattle destined for export were infected with foot and mouth disease by intralingual injection of virus. A second "type" of virus was discovered during the year and subsequently the cattle were injected with a mixture of both. Neither of the viruses has yet been typed.

IX. Anthrax Vaccine.

All export cattle were injected with anthrax vaccine supplied from the Kenya Veterinary Service.

Sale of Laboratory Products.

A price has been fixed for the sale of some of the laboratory products, but decision on whether they are issued on payment or free of charge is usually left to the field staff. The prices per dose are:—Cattle plague antiserum—10 piastres, cattle plague vaccine—5 piastres, anthrax vaccine—2½ piastres, blackleg vaccine—5 piastres, horse sickness vaccine—50 piastres, and antrypol—25 piastres.

(£E 1.=100 piastres=£.1-0-6d.).

The following revenue was derived from the sale of these products during 1946.

Cattle plague antiserum	£E.	}	..	..	£E.
Cattle plague vaccine	£E.				11,043
Anthrax vaccine	£E.		..	..	309
Horse Sickness vaccine	£E.		..	..	482
Antrypol	£E.		..	..	14,680
TOTAL					<u>26,514</u>

The following table shows the distribution of the products supplied by the laboratory.

INTERNAL	Cattle plague Anti- serum Doses (30cc)	Cattle plague vaccine Doses (10cc)	Pleuro- neum- onia vaccine Doses	Anthrax vaccine Doses	Blackleg vaccine Doses	Horse sickness vaccine Doses	Antrypol Doses (5gm)
Kordofan Province ..	20,800	168,020	30,745	28,000	—	58	28,162
Blue Nile Province ..	25,600	26,940	3,325	1,500	—	396	16,700
Darfur Province ..	17,600	38,340	7,600	—	—	206	8,500
Kassala Province ..	4,800	20,820	50	—	1,800	148	10,999
Upper Nile and Equatoria Provinces	48,720	71,160	15,325	200	—	—	—
Khartoum and Northern Provinces	—	12,380	—	—	—	243	2,124
Headquarters (Reserve)	70,400	—	—	—	—	—	—
Laboratory	—	—	—	—	—	23	38
EXTERNAL							
Aden	—	1,200	—	—	—	—	—
Palestine	—	10,020	—	—	—	—	—
Eritrea (Army) ..	—	—	—	—	—	482	400
TOTAL	170,080	348,880	57,045	29,700	1,800	1,556	66,923

X. Examination of Specimens.

The number of specimens sent to the laboratory for examination was 1,542. The diagnoses were representative of those made almost every year and included:—

CATTLE : *Tryp. congolense*. *Tryp. vivax*, anthrax, haemorrhagic septicaemia, *actinomyces farcinicus* and psoroptic mange.

SHEEP : Anthrax.

CAMELS : *Tryp. evansi*, sarcoptic mange.

EQUIDAE : Cryptococcus infections, ringworm, *Tryp. brucei*.

POULTRY : Spirochaetosis, fowl pox.

C. RESEARCH.

1. CAMEL TRYPANOSOMIASIS.

A few camels which had failed to respond to repeated routine antrypol injections were sent to the laboratory. Some of them were injected with 20 gms (*i.e.* four times the normal dose) of antrypol and others with 20 gms of naganol (the Bayer equivalent of antrypol) but trypanosomes continued to be seen in the blood of all of them. It seemed probable from these results that failure to cure was due to "resistance" of the trypanosomes to the drug and not faulty composition of the particular batch of antrypol. Dr. Davey of the Imperial Chemical Industries later confirmed the existence of marked resistance to antrypol in this strain of trypanosomes.

The Trypanocidal Action of Stilbamidine and Pentamidine.

In view of the therapeutic value of these compounds in the treatment of allied infections it was decided to try the effect of them on *T. evansi* in camels. Experimental work was limited to single injection treatment since any method entailing multiple injections would be impracticable under field conditions. The strain of trypanosomes used throughout was an antrypol-resistant one.

Stilbamidine.

(a) Intravenous route.

Doses of 10.0 mg., 5.0 mg., 2.5 mg., 1.0 mg., and 0.5 mg., per kilo body weight of stilbamidine isethionate were each injected intravenously into two camels infected with *T. evansi*.

The two camels which received 10.0 mg. per kilo failed to get up for a few minutes after the injection and were very unsteady during the rest of that and the following day. One died on the second day and the other on the third day after injection.

The two camels which received 5.0 mg were unsteady for half an hour after their injection and were off their feed for the rest of the day. Both appeared normal afterwards but one of them collapsed on the 19th day and died on the 20th. Death was due to delayed poisoning by the drug.

The only organs that appeared abnormal on post-mortem examination were the liver and kidneys. The histology of the liver showed extensive fragmentation of columns, focal necrosis in some areas and necrosis of scattered cells. There was neither congestion nor cellular infiltration.

The kidney was acutely engorged and especially the glomeruli and around the loops of Henle and the collecting tubules. There were many focal small haemorrhages between the latter and the tubules showed changes from cloudy swelling to marked necrosis with disappearance of epithelium.

The other camel survived and daily blood examination was negative for 75 days.

The two camels which received 2.5 mg per kilo stopped feeding for the first day but otherwise appeared normal. Trypanosomes appeared in the blood of one of them on the 25th day but the other remained negative for 70 days.

The camels which received smaller doses showed no reactions following injection.

The results of the experiment are summarised in the following table.

TABLE I.

Effect of single intravenous injection of Stilbamidine Isethionate.

Camel No.	Rate per kilo	Reaction.	Blood free from Trypanosomes.
2	0.5 mg	Nothing apparent	22 days. Reappeared 27th day.
5	0.5 mg	„ „	75 days.
6	1.0 mg	„ „	75 days.
10	1.0 mg	„ „	15 days. Reappeared 16th day.
11	2.5 mg	Stopped feeding first day.	24 days. Reappeared 25th day.
12	2.5 mg	„ „ „	75 days.

TABLE I—*Contd.*

Camel No.	Rate per kilo	Reaction	Blood free from Trypanosomes
13	5.0 mg	Unsteadiness for $\frac{1}{2}$ hour. Off feed first day.	75 days.
14	5.0 mg	Off feed first day. Collapsed 19th day and died next day.	20 days.
15	10.0 mg	Very unsteady. Stopped feeding. Died 2nd day.	
16	10.0 mg	Very unsteady. Stopped feeding. Died 3rd day.	

Conclusion : Stilbamidine isethionate was unsafe if injected intravenously at 5 mg per kilo and could not be relied upon to cure at smaller dosages.

(b) Subcutaneous route.

The effect of subcutaneous injection of stilbamidine isethionate was tried on one camel (No.7) only. The dosage was 10 mg per kilo and made up in 4 per cent. solution and injected on both sides of the body.

The camel was unsteady after the injection and fed poorly until it collapsed on the 9th day and died on the 10th.

No further experiments were done with this compound as it seemed evident that even if it were effective its therapeutic index would be too low for general use.

Pentamidine.

(a) Intravenous route.

Two camels each infected with *T. evansi*, were injected intravenously with an aqueous solution of pentamidine isethionate at the same range of dosages as used in the experiment with stilbamidine isethionate.

The results were very similar and are summarised in the following table :—

TABLE II.

Effect of a single intravenous injection of pentamidine isethionate.

Camel No.	Dosage in mg. per kilo.	Reaction.	Blood free from trypanosomes.	Hg Cl. ₂ test.
1	0.5	Nothing apparent	75 days	Remained positive.
2	0.5	„ „	82 „	„ „
4	1.0	„ „	120 „	Became negative.
7	1.0	„ „	116 „	Remained positive.
3	2.5	„ „	10 „	„ „
9	2.5	„ „	33 „	„ „
8	5.0	Unsteadiness and off food for rest of the day.	40 „	„ „
10	5.0	do.	57 „	„ „
11	10.0	Collapsed and died within 10 minutes.	—	—

Conclusion: Pentamidine isethionate given intravenously failed to cure at safe dosages.

(b) Subcutaneous route.

Having previously ascertained that the subcutaneous injection of 10 mg per kilo produced no more visible reaction than a slight uneasiness for a few hours, an experiment using the same range of doses injected subcutaneously was arranged.

The only camels receiving smaller doses, which displayed any reaction were two out of three injected at 5 mg per kilo. These were off their feed for two days.

The results are summarised in the following table.

TABLE III.

Effect of single subcutaneous injection of pentamidine isethionate.

No. of camel.	Rate per kilo.	Daily blood examination negative following injection.	Hg. Cl. ₂ test.	Day and result of guinea pig inoculation.
5	10.0 mg	66 days ...	became negative ...	50th negative.*
6	5.0 mg	54	„ „ ...	33rd negative.*
9	5.0 mg	102	„ „ ...	33rd negative.
19	5.0 mg	21	remained positive ...	not done.*
10	2.5 mg	99	became negative ...	29th negative.
12	2.5 mg	38	became negative ...	25th negative.*
18	2.5 mg	30	remained positive ...	not done.*
2	1.0 mg	56	became negative ...	22nd negative.*
8	1.0 mg	16	became negative ...	not done.*
1	0.5 mg	57	became very weak ...	not done.
3	0.5 mg	57	„ „ „ ...	not done.
4	0.5 mg	20	remained positive ...	not done.*

*The results of this experiment were largely nullified by the fact that four fresh camels infected with *T. evansi* were inadvertently introduced into the same compound as the experimental animals, and the camels No. 5, 6, 19, 12, 18, 2, 8, and 4 in fact showed trypanosomes in their blood on the day following that shown in column 3 of Table III.

During past years no biting flies had been seen in the compound at the time of the year when this experiment was carried out but during this year many *Lyperosia minuta* were found following investigation.

Taking into consideration the relatively long periods for which daily blood examinations were negative, the negative results of sub-inoculations in guinea pigs (there were not enough available for all camels) and serum changes indicated by the mercuric chloride reaction, it seemed possible that the reappearance of trypanosomes was due to reinfection and not to relapse. Further experiments taking strict precautions against this possibility were afterwards arranged.

Phenanthridinium Compounds 897 and 1553.

The effect of the intravenous injection of these two drugs on *T. evansi* infected camels was observed. Two camels each were injected at the rate 2 mg per kilo but not one of them was cured.

The results are summarised in the following table.

TABLE IV.
Effect of single intravenous injection of 2 mg per kilo of 0.5% solution of phenanthridinium 897 and 1553, respectively.

No. of camel.	Drug No.	Reaction.	Results.
22	897	Nothing visible	Tryps reappeared 26th day.
23	897	do	„ „ 8th day.
20	1553	do	„ „ 13th day.
21	1553	do	„ „ 11th day.

II. CATTLE TRYPANOSOMIASIS—*T. CONGOLENSE*

Experimental treatment of *T. congolense* infection in cattle was carried out using phenanthridinium compounds 897 and 1553, respectively, kindly supplied in the first place by the Department of Scientific and Industrial Research, Teddington and later, No. 1553, by May and Baker Ltd.

Phenanthridinium 897.

(7-amino-9-(p-aminophenyl)-10 methyl phenanthridinium chloride).

Experimental work on this drug was done at the Malakal laboratory using cattle naturally infected with *T. congolense*. The only dosage tried was 2 mg (approx.) per kilo body weight in a 1 per cent. solution. No laboratory animals were available for sub-inoculation tests and the criterion for judging cures was failure to find trypanosomes on twice weekly examinations of wet blood smears over a period of ten weeks.

(a) Subcutaneous route.

Six cattle were injected and four of them were cured. The other two relapsed 18 and 20 days, respectively, after the injection. They were afterwards given a course of stibophen injections and were cured.

In each animal large hard swellings, up to 12 inches in diameter developed in a few days at the injection sites and persisted for nearly two months. The cattle were very lame and had to be hand-fed during part of the experiment.

(b) Intramuscular route.

Six cattle were injected into the muscles of the thigh, and four of them were cured. The other two relapsed approximately two months after injection. They were given a second injection which cured them.

Small swellings appeared at the injection sites. They caused little inconvenience and had all disappeared in a fortnight.

(c) Intravenous route.

Five cattle were injected and three of them were cured. The other two relapsed six and seven weeks, respectively, after injection, and relapsed again after a second similar injection. A subsequent course of stibophen injections cured them.

There was an improvement in the general condition of all the cattle in which blood examinations were negative.

The results are summarised in the following table.

TABLE V.

Treatment of *T. congolense* in cattle by injection of 1% solution of phenanthridinium 897.

Bulls treated.	Dose per kilo.	Route.	Cured	Relapsed	% Cured.
6	2.0 mg	Subcutaneous ...	4	2	66
6	2.0 mg	Intramuscular ...	4	2	66
5	2.0 mg	Intravenous ...	3	2	60

Phenanthridinium 1553 (Dimidium bromide).

(2:7-diamino-9 phenyl-10-methyl phenanthridinium bromide)

This drug was also tried out at the Malakal laboratory on cattle naturally infected with *T. congolense*. Dosages of approximately 1 mg and 2 mg per kilo body weight, respectively, were injected subcutaneously and intramuscularly. The criterion for judging cures was the same as for phenanthridinium 897.

(a) Subcutaneous route.

(1) 1 *mg per kilo*. Sixteen infected bulls were treated and fifteen of them were cured. The remaining bull relapsed after 10 days and again 15 days after a second similar injection. A subsequent course of stibophen injections cured it.

(2) 2 *mg per kilo*. Eighteen bulls were treated and all but one were cured. This bull showed trypanosomes in its blood eight weeks after injection.

Swellings developed at the inoculation sites in all the cattle. Of those which received 1 *mg per kilo*, about a half of them developed small swellings which caused little inconvenience, but in the others, large, hard, painful swellings up to 10 inches in diameter appeared and for several days the cattle were too lame to walk in search for food. The local reaction in those which received 2 *mg per kilo* was a little more severe. All the cattle showed marked loss of condition.

(b) Intramuscular route.

(1) 1 *mg per kilo*. Five cattle were injected in the muscles of the thighs and all were cured. Small swellings, about 2 inches in diameter, appeared at the injection sites but caused no inconvenience.

(2) 2 *mg per kilo*. Four cattle were injected and all were cured. The local reaction was similar to that following half the dosage.

As far as could be judged there was no change in the general condition of the cattle treated intramuscularly.

The results of these experiments are summarised in the following table.

TABLE VI.

Treatment of *T. congolense* in cattle by the injection of 1% solution of phenanthridinium 1553.

Bulls treated.	Dose per kilo.	Route.	Cured	Relapsed	% Cured.
16	1.0 mg	Subcutaneous ...	16	1	88
20	2.0 mg	„ ...	20	1	95
5	1.0 mg	Intramuscular ...	5	0	100
4	2.0 mg	„ ...	4	0	100

Treatment by the intramuscular route was later carried out on a larger number of naturally infected cattle. Intravenous injection was also tried.

These results are summarised in Table VII.

TABLE VII.

Treatment with phenanthridinium 1553 of cattle naturally infected with *T. congolense*.

Number of bulls injected.	Route	Approximate rate/kilo	Local reaction.	Examination of wet blood smears every 3 days for 33 days.
16	I/M	2 mg.	Swellings about 2" diam. in most cases. Caused little or no inconvenience.	All negative.
20	I/M	1 mg.	do.	All negative except one in which <i>T. congolense</i> was found on 30th day.
10	I/V	2 mg.	Small swellings in three cattle.	All negative.
10	I/V	1 mg.	Small swellings in two cattle.	All negative.
9	I/V	2 mg.	Small swellings in three cattle.	All negative.
10	I/V	1 mg.	Small swellings in three cattle.	All negative.

These results justified a more extensive trial of the drug and arrangements were made for conducting a large scale field experiment in 1947.

D. SUMMARY.

This year has again been characterised by an increase in almost all sections of routine work. The output of cattle plague antiserum was slightly less than in the preceding year but it was the maximum possible and the comparison indicates the relative success of a maximum effort. The issues of pleuropneumonia vaccine were 60 per cent. more than those for 1945, and nearly three hundred and fifty thousand doses of cattle plague vaccine were distributed.

Research was handicapped by lack of staff and extra routine work. Investigations into the chemo-therapy of the antrypol-resistant *T. evansi* infection in camels and *T. congolense* infection in cattle were made and the results justified trials of new drugs in field experiments.

In conclusion it is necessary to acknowledge the good work done by the laboratory staff, and particularly by the two senior Veterinary Officers, one of whom was in sole charge of the Malakal laboratory and the other in charge of the Khartoum laboratory during the Senior Research Officer's absence on leave and on duty. Increasing responsibilities are placed on them annually in order to deal with the mounting demands for laboratory products.

J. T. R. EVANS

Senior Research Officer

Khartoum 5th March, 1947.

